

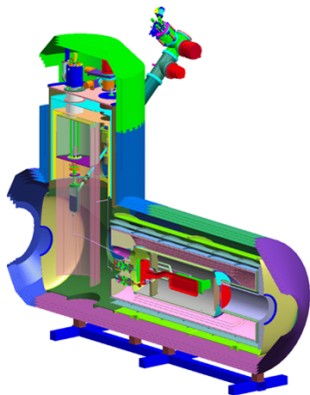
# *Neutron Guide Optimization*

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**UK** UNIVERSITY OF KENTUCKY

**EDM**

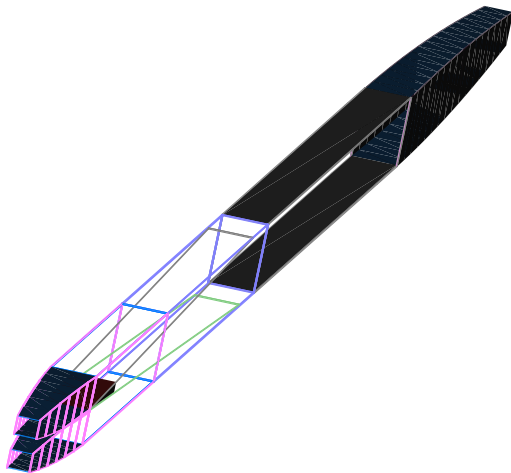


Overall goal: Optimize  $P^2 \times T$  in target cells

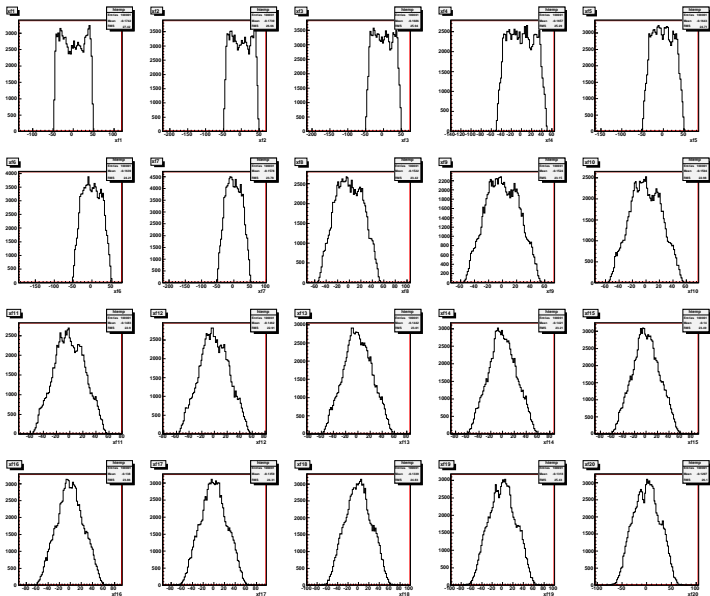
## Parameters

- Optimize shape of splitter guides  $\Rightarrow$  best transport to cells
- Optimize polarization
  - Transmission Polarizer
  - Reflection Polarizer
  - Transmission-Reflection Polarizer

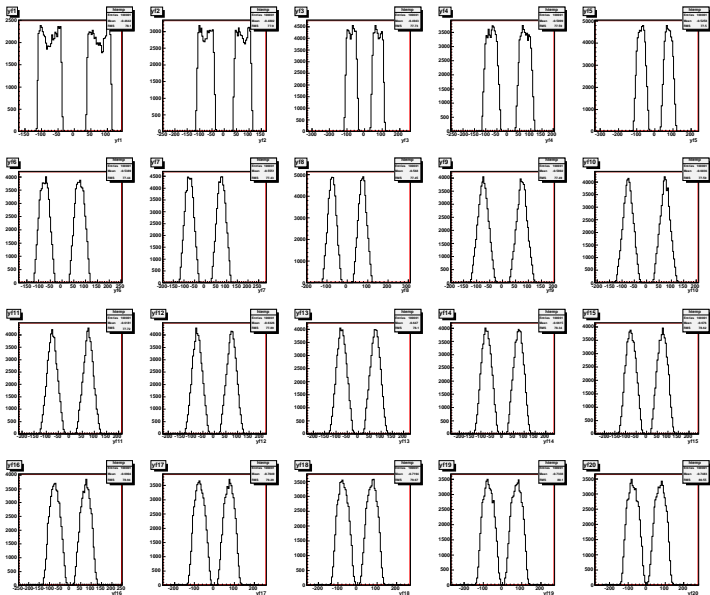
*Note:* Geometry used in results presented here is not correct!!



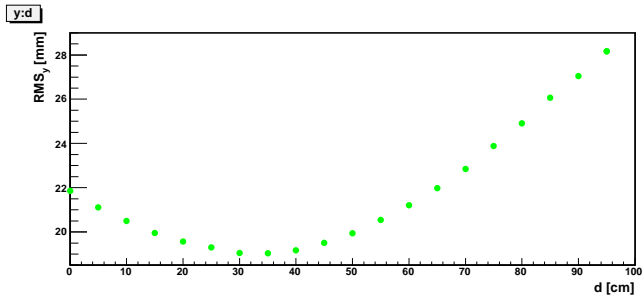
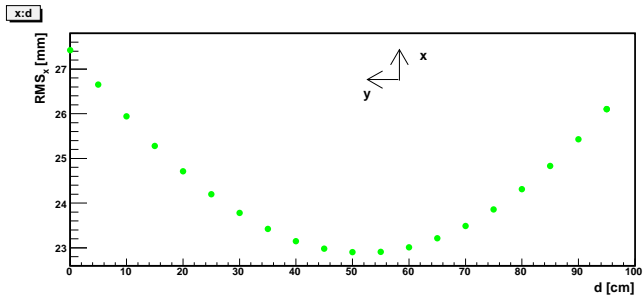
# Beam Profile in X



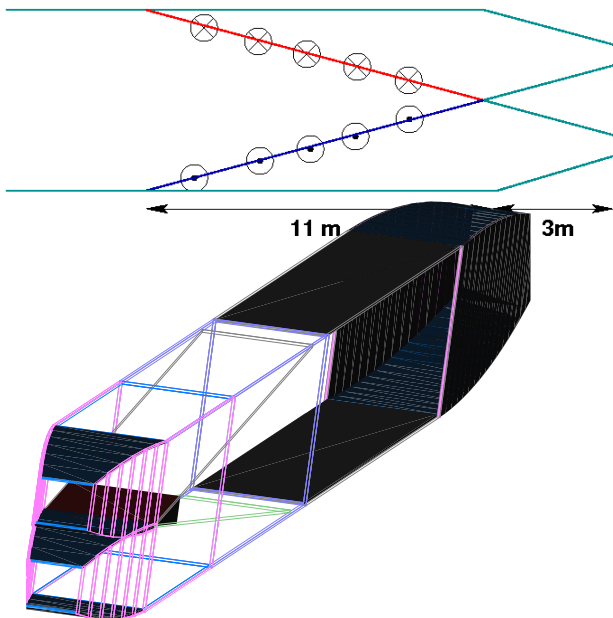
# Beam Profile in Y



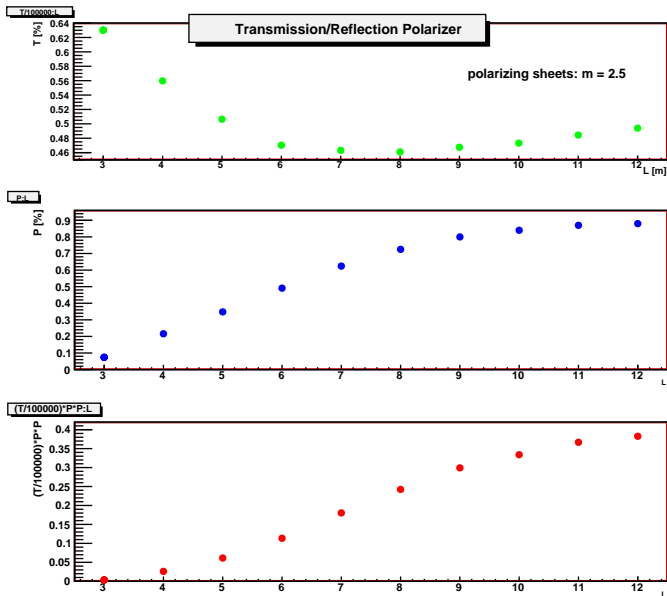
# Beam Profile vs Distance



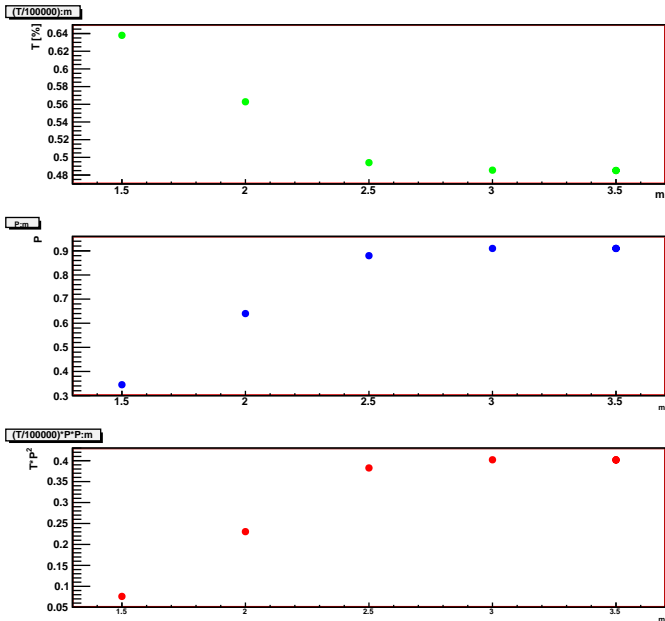
# The Transmission-Reflection Polarizer



# Expectations for Different Sheet Lengths



# Different $m_{\text{sheet}}$ Values



## Summary of Transmission-Reflection Polarizer

- $L = 11 \text{ m}$
- $m_{\text{sheet}} = 2.5$
- sidewalls are  $m = 3.5$  downstream (behind) of the polarizing sheets.
- no stopper in the center

comment	$T$	$P$	$T \cdot P^2$
perfect reflection everywhere	0.997	1	0.997
realistic reflection	0.4844	0.87	0.367

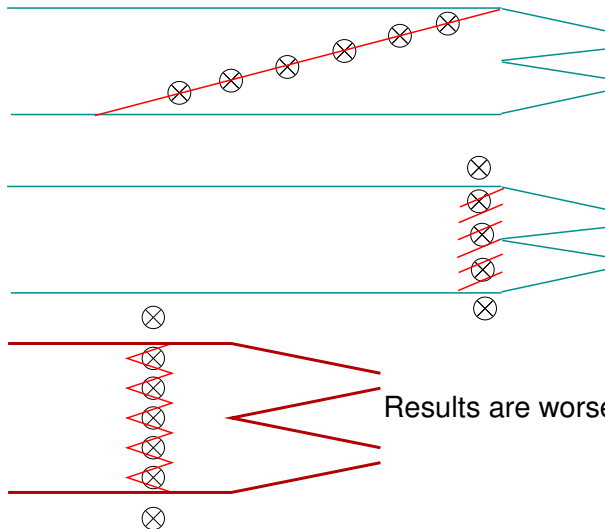
Geometry as above, only one direction of magnetization

- $L = 11$  m
- $m_{sheet} = 2.5$
- sidewalls are  $m = 3.5$  downstream (behind) of the polarizing sheets.

comment	$T$	$P$	$T \cdot P^2$
perfect reflection everywhere	0.4989	1	0.50
realistic reflection	0.4902	0.38	0.071
realistic reflection, single sheet	0.4882	0.34/0.44	0.056/0.095

Here we see the effect of imperfect reflection due to multiple bounces on the sheets for the non-transmitted part of the beam.  $n$  bounces reduce the reflectivity more than  $R^n$  (angle of incidence gets larger after each bounce).

# Simulations of Other Geometries

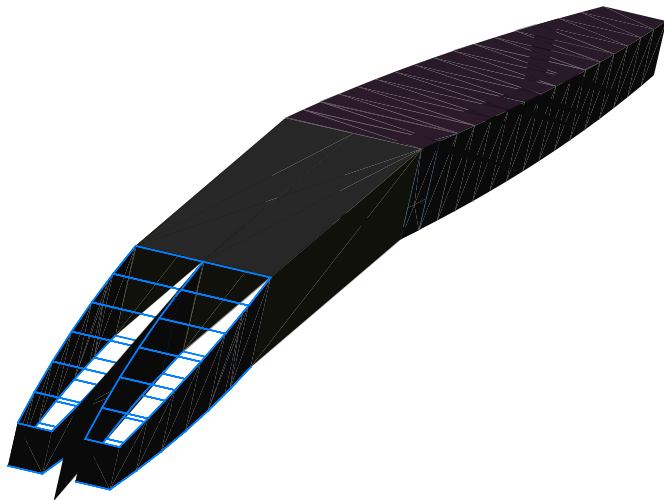


- No polarizing sheets but 22 m of the magnetized sidewalls (in the straight section).
- $m = 2.5$  everywhere.

comment	$T$	$P$	$T \cdot P^2$
perfect reflection, no ballistic entry horn	0.5429	0.68	0.251
perfect reflection, ballistic entry horn	0.6732	0.48	0.155
realistic reflection, no ballistic entry horn	0.2004	0.68	0.0926
realistic reflection, ballistic entry horn	0.4169	0.47	0.0921
perfect reflection, bent guide	0.4983	1	0.498
realistic reflection, bent guide	0.2857	1	0.286

⇒ No-line-of-sight for bent guide. Only one wall magnetized

Note: Sheets in Transmission-Reflection Polarizer increase transverse momentum ⇒ transport to cell might be worse.



## Plan for the near future

- Correct and optimize guide geometry
- Try “single bounce” reflection polarizer  $\Rightarrow$  more compact magnetization region, cheaper
- Full optimization of  $P^2 \times T$  at center of cell  $\Rightarrow$  Chris